Anaesthesia and Pain Management for Endo – Exo Femoral Prosthesis (EEFP)

Bridging the Gap from Surgery to Rehabilitation

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Introduction

• Amputee patients are a unique group of patients that have special anaesthetic concerns.
• Suboptimal anaesthetic management and analgesia can have significant impact on patients recovery.
• Contributing to morbidity and surgical stress responses.
• Poor pain management may lead to chronic pain syndromes
• IPL patients require to mobilise and rehabilitation
Anaesthetic Consideration for IPL

- Patients have usually had multiple operations
- Often have unresolved chronic pain (CRPS) with phantom limb pain.
- Opioid tolerance.
- On multiple medications.
- Often have medical comorbidities
- They may complex psychosocial issues
Response to Surgery and Injury

- Post Operative Pain
- Surgical Trauma
- Psychological, environmental, social factors

Acute Phase
- “cytokines”
  - Neurohumoral
  - Metabolic
  - Immune
  - responses

Injury Response
- Inflammation
- Hyperalgesia
- Catabolism
- Hypercoagulable state
- Physical, mental deactivation
Modification of the Metabolic Responses to Surgery

- Metabolic responses may delay recovery and worsen pain
- Modification through pain relief alone with opioid have not been successful
- Multiinterventional and rehabilitation strategy the basis of which requires very effective pain relief
- PROSPECT group

Post op rehabilitation should include pharmacological, physical, psychological, and nutritional components of management

Analgesic therapeutic goals for Orthopaedic Surgery

- Provide optimal analgesia in the immediate postoperative period
- Implement strategies to prevent primary and secondary hyperalgesia and the progression to and development of chronic pain syndromes.
- Reduce the incidence of opioid related side effects.
- Attenuate the surgical stress response and inflammation, and worsening of pre-existing medical conditions, bleeding, and deep venous thrombosis
- Reduce the impact of prolonged motor blockage from regional anaesthesia.
- Preserve neurocognitive function and prevent postoperative confusion.
- Promote clinical conditions that help early comfortable mobilisation and prevent long term sequelae from the initial surgery.
Balancing Act

Analgesia

Mobility

Cognitive Function
Pain

• Acute Pain is defined as a “Pain of recent onset and probable limited duration. It usually has an identifiable temporal and causal relationship to injury or disease.

• Chronic pain is more complex and persists beyond the normal time of healing of an injury often of multifactorial aetiology and sometimes there may not be a clearly definable cause.

• They both represent a continuum of disease progression.

• The pathophysiological processes that occur after tissue or nerve injury means that acute pain may become persistent and progress to chronic pain syndromes.
Pain Pathways

- **Central Sensitization**
  - CNS
  - Spinal Wind-up

- **Spinal Cord**

- **Primary Hyperalgesia**

- **Secondary Hyperalgesia**

- **Peripheral Sensitization**

- **Inflammatory Mediators**:
  - Hydrogen Ions, Histamines, Purines, Leukotrienes, Norepinephrine, Potassium Ions, Cytokines, Nerve Growth Factor, BK, PGs, 5-HT, Neuropeptides

- **Surgical Trauma**
Development of Perioperative strategy

- Evidence Based approach
- Choice of initial operative anaesthesia (GA or Regional)
- Models of acute pain management (multimodal)
- Models of prevention of the development of chronic pain (adjuvant agents)
- Literature review of pain management
  - Acute Phase
  - Arthroplasty
  - Phantom limb pain
Pre-emptive Analgesia

- Pre-emptive Analgesia is defined where a preoperative treatment intervention is more effective than the identical treatment intervention administered after the initial surgical incision or surgery.
- Pain relief prior to surgery may enhance postoperative pain management.
- Treatment modalities should be directed at the periphery, along the sensory axons, and along the central neurons to be effective.
- The use of nonsteroidal anti-inflammatory drugs, acetaminophen, local anesthetics, α-2 agonists (e.g., clonidine), α2-δ ligands (e.g., Gabapentin and Pregabalin), ketamine, and opioids, either alone or in combination.
Preventative Analgesia (Protective)

- Preventative Analgesia is defined in terms when post-operative pain and/or analgesia consumption is reduced relative to another treatment, as long as the effect is observed at a point in time that exceeds the expected duration of action of the intervention.
- Central neuroplasticity is induced by preoperative, intraoperative, and postoperative nociceptive inputs.
- Reduce the central sensitization that arises from noxious inputs experienced throughout the entire perioperative period and not just from those occurring during the surgical incision.
- Gagapentinoids, LA infiltration, NSAIDS,
- Level 1 evidence for Ketamine use
Multimodal analgesia

- The concept of multimodal analgesia was introduced more than a decade ago.
- Technique to improve analgesia and reduce the prevalence of opioid-related adverse events.
- The rationale for this strategy is the achievement of sufficient analgesia due to the additive or synergistic effects of different analgesics.
- Each agent targets a particular area of the nociceptive and neural pathways allowing a reduction in the doses of these drugs and thus a lower prevalence of adverse effects of each agent.
- Multimodal analgesic regimens for orthopaedic surgery include local anaesthetics, $\alpha$-2 agonists (e.g., clonidine), nonsteroidal anti-inflammatory drugs, acetaminophen, ketamine, $\alpha$2-$\delta$ ligands (e.g., gabapentin and pregabalin), and opioids.
- The adjuvant agents used will reduce the overall opioid consumption.

Analgesia may be achieved by
1. Enhanced inhibition e.g. Opioid, Clonidine, Antidepressants
2. Reduced transmission eg LA, Regional, Ketamine

Pain Pathways
Pain Management strategy - 1st Stage

- Preventative therapies
- Regional Anaesthesia (Spinal) and sedation
- Adjuvant agents (clonidine, ketamine, mg)
- Local anaesthetic adjunct infiltration
- Regular oxycodone (incl slow release)
- Use Hydromorphone if sensitive to usual opioids
- Avoid PCA
- Regular paracetamol and NSAIDS
- Tramadol (incl slow release)
Pain Management strategy - II stage

- General anaesthesia – Remifentanyl based
- Adjuvant agents (clonidine, ketamine, mg)
- Local anaesthetic adjuvant infiltration
- Regular oxycodone (incl slow release) avoid PCA
- Regular paracetamol and NSAIDS
- Tramadol
- Gabapentiniods
- Use peripheral nerve blocks
Problems encountered in Pain Management

- Inter-individual variation in analgesic requirements
- Complex pain histories due to previous surgery esp. tolerance, drug sensitivities
- Reactivation of phantom limb pain
- Variation in analgesic requirements in different stages within the timeline of rehabilitation and adaption of the prosthesis
PolyPharmacy

- **Clonidine** - alpha 2 agonists that cause vasoconstriction peripherally, and in the CNS they reduce sympathetic outflow and reduce catecholamine release.

- **Ketamine** - A dissociative anaesthetic agent acts as a non-competitive antagonist of the N-methyl D-aspartate receptor (NMDA) which are located peripherally and centrally within the CNS affecting the propagation in pain pathways.

- **Tricyclic antidepressants and SSRI’s** - Effective in the treatment of chronic neuropathic states

- **Paracetamol and NSAID’s**
Advantages of intraoperative use of regional anaesthesia

- Reduces blood loss: 30% reduction in intraoperative blood loss compared with GA alone due to lower arterial and venous pressures.
- Reduces rates of (DVT): By improving blood flow through the legs secondary to sympathectomy-induced vasodilatation and may also reduce perioperative hypercoagulability that occurs as a result of the surgical stress response.
- Avoids common adverse effects of GA: Such as post op nausea and vomiting, sore throat, alteration of mental status, and cognitive dysfunction.
- Reduced short term mortality.
- Improves pain control. Pre-emptive pain management may reduce subsequent pain in the days to weeks following surgery and hence may improve the patient's ability to tolerate physical therapy.
- Reduction in post-operative confusion in the elderly.
- Can be used as sole technique in lower limb surgery if unsuitable for general anaesthesia.

Balancing Act

Analgesia

Mobility

Cognitive Function

GA and Opioid
- Reasonable analgesia
- Reduced cognitive function
- Reasonable mobility initially

Regional anaesthesia
- Better Analgesia
- Good cognitive function
- Poor Mobility initially
High Dose LA Infiltration

- Local anaesthetic can be administered in skin incision sites, intra-articularly (knee and shoulder), or on bone wounds (iliac crest graft sites).
- The infiltration of wounds with local anaesthetics not only provides analgesia but also appears to reduce the local inflammatory response to trauma or surgery.
- May help reduce the up regulation of peripheral nociceptors that manifests as hypersensitivity to a stimulus. Bupivacaine or ropivacaine provides approximately 6 or more hours of analgesia.
- Alternatively, catheters can be placed at these locations, so that either local anaesthetic can be infused continuously or boluses can be administered with patient-controlled pumps.

Local Anaesthetic Adjuvant Infiltration (LAAIF)

- Follows the principle of high dose LA infiltration
- Addition of adjuvant drugs to prolong the analgesic effects hence opioid sparing.
- Ropivacaine 0.2% 50mls
  - Adrenaline
  - Clonidine
  - Ketamine
  - Ketorolac
  - Midazolam
Gabapentinoids

- Evidence that they provide effective postoperative analgesia when they are administered pre-emptively before an operation.
- A reduction of opioid consumption ranging from 20 to 62%
- Improves pain on movement.
- Reduced opioid related side effects nausea, vomiting and urinary retention.
- Can be given as single preop dose or continued for 14 days
- Adverse events associated with the long-term use of gabapentin and pregabalin are dizziness, somnolence, and peripheral oedema

Conclusion

• Promote strategies to facilitate rehabilitation in orthopaedic patients
• The aim to improve analgesia, reduce inflammation, and cognition to improve mobility
• All anaesthetic techniques have their advantages and disadvantages
• Use a multimodal approach to pain management

• Remember where you want to be before you even start
Scientific Evidence

• 3rd Edition 2010
• Written by a multidisciplinary team
• Published by the NHMRC
• Endorsed by the IASP, American Academy of Pain Medicine and various speciality colleges
• The purpose of the document is to combine a review of the best available evidence for pain management with current clinical and expert practice
Rescue Analgesia

- Increasing of gabapentinoids
- Addition of tricyclic antidepressants
- Low dose ketamine infusion
- Topical therapies
- TENS machine